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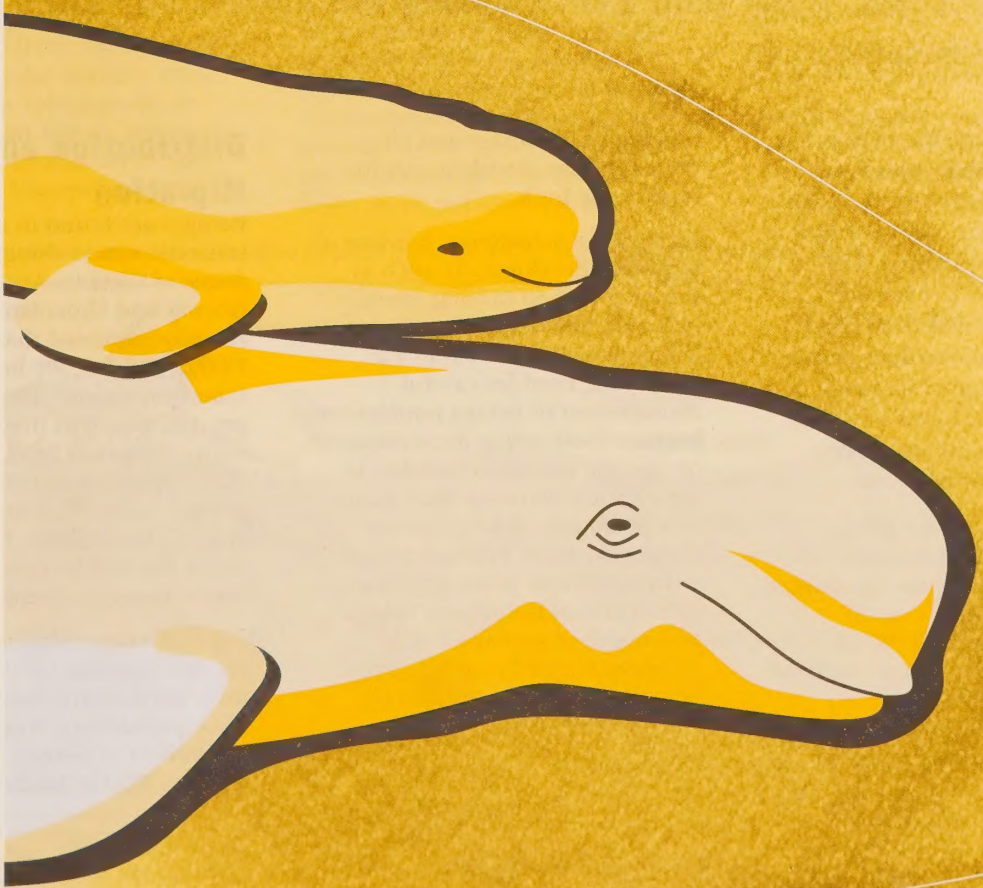
BELUGA



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BELUGA

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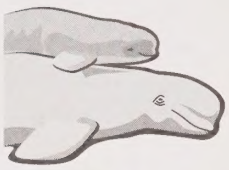


The Beluga

Figure 1.

Introduction

Beluga, or white whales, are an Arctic species. For the people of the Canadian Arctic – the Inuvialuit of the western Canadian Arctic, the Inuit of Nunavik (Northern Quebec) and Nunavut – belugas are a very important food resource. Their presence near a settlement or hunting camp is always greeted with excitement. The hunts are often cooperative efforts involving several hunters and vessels, with the proceeds of the hunt shared among the hunters and saved for other community members.

In recent years, the beluga has attracted public attention, especially with respect to the problems of toxic contaminants and human disturbance. The St. Lawrence Estuary beluga population, isolated from those in the Arctic and residing in the southern extreme of its range, has turned the beluga into a symbol for the conservation of marine habitats in Canada.

Public awareness of the beluga has also been raised through the recognition given by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) to the *endangered* or *threatened* status of some beluga populations in Canadian waters. These populations have suffered from past commercial hunting for their skin and oil. Presently, they are taken only for food by the Inuit.

Increases in subsistence hunting or industrial development, such as shipping and oil drilling, could influence the well being of some beluga populations. There is a continuing need for careful management of beluga populations because their strong dependence on specific nearshore habitats in the summer increases their exposure to human activity. Recent developments in Inuit land claim settlements and co-management, as well as new findings in beluga ecology, show promise for the conservation and protection of beluga populations in Canada.

Distribution and Migration

Belugas are found in arctic and subarctic waters along the northern coasts of Canada, Alaska, Russia, Norway and Greenland. It is roughly estimated that between 72,000 and 144,000 belugas live in Canadian waters[1]. These animals are distributed in the western Arctic (Beaufort Sea), high Arctic (Lancaster Sound, Baffin Bay), eastern Arctic (Cumberland Sound and southeast Baffin, Hudson Bay, James Bay and Ungava Bay) and in the St. Lawrence Estuary.

The various populations of belugas are distinguished on the basis of their summer distribution and, for some populations, by measurable differences in genetic and chemical analyses. Within Hudson Bay, for

[1] *The first number represents how many have been estimated near the surface during aerial surveys across the Arctic. The second number is how many there might be if one assumes that an average of one whale is missed for every one seen during surveys.*

example, some summer populations are genetically distinct from others even though all of these populations occupy Hudson Strait in winter. The St. Lawrence population is considered now to be isolated from other beluga populations even though there was likely some exchange with other populations in the past when the distribution of the species was much wider.

In summer, belugas gather in specific estuaries, where a river meets the ocean, and their adjacent waters for several weeks. The summer habitat is characterized by the presence of shallow, brackish and relatively warm waters and sandy or muddy substrates. They also range along coastal marine waters and offshore waters surrounding these estuaries for variable periods of time, sometimes returning to the same estuary or using adjacent ones. In the western Arctic, for example, belugas can range 800 kilometres from the Mackenzie Estuary during the summer while, in Hudson Bay, belugas seldom range more than 100 or 200 kilometres from the estuaries of the Churchill and Nastapoka Rivers.

The beluga's winter distribution is not as well understood. They are dependent on areas of shifting ice where open water provides access to air. Some areas of open water, called polynyas, recur in the same locations year after year. Occasionally, belugas may become entrapped when these features freeze, which can result in the death of some whales.

The distance between their summer and winter habitats requires that some beluga populations migrate over long distances during the spring and autumn.

For example, some belugas travel between the Beaufort Sea, where they live in the summer, to the Bering Sea in the winter via the western Chukchi Sea of Russia. The distance covered is in excess of 2000 kilometres. Belugas are not fast swimming whales. Their normal travelling speed is 9 to 10 kilometres per hour (6 knots) and long migrations can take a few months to accomplish. During these migrations, they navigate through dense pack ice, making use of breathing holes between ice floes. Some populations, like those of the St. Lawrence Estuary and Cumberland Sound, are apparently more sedentary, ranging only a few hundred kilometres from their summer range.

Biology and Physiology

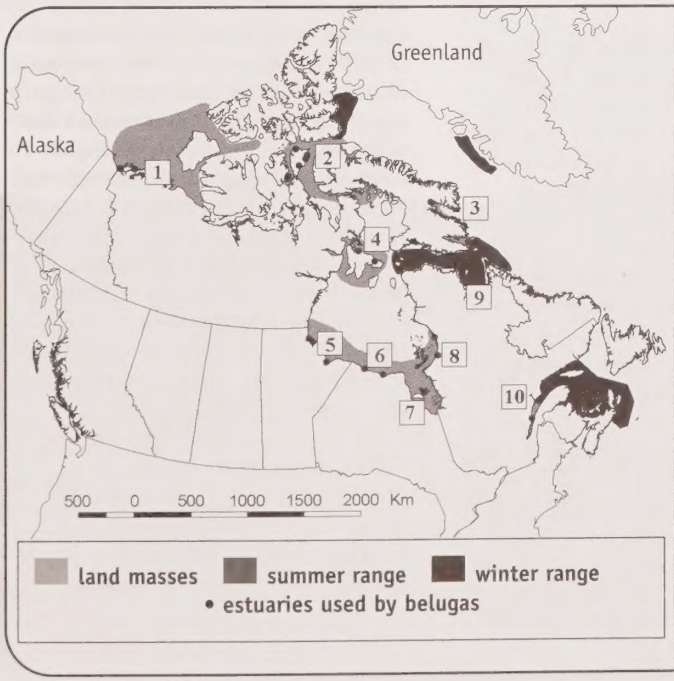
The white colour of the beluga and the absence of a dorsal fin are the main distinguishing features, as indicated by the scientific name *Delphinapterus leucas*, which translates literally as "the white dolphin without a wing".

The common name "beluga" means "the white one" in Russian. In reality, only adults are white; calves are born brown or dark grey and gradually pale to become totally white between six and eight years of age.

Adult males (3.65 to 4.25 metres and 450 to 1000 kilograms) are larger than females (3.05 to 3.65 metres and 250 to 700 kilograms). Newborn calves measure about 1.5 metres and weigh 50-80 kilograms at birth.

Sexual maturity occurs at eight years of age in males and at approximately five years in females. Mating takes place in April-May.

Figure 2. Beluga summer and winter distribution ranges in Canadian waters, and estimates of beluga populations in Canada.



Area		Numbers estimated *
1.	Beaufort Sea	20,000 – 40,000
2.	High Arctic	20,000 – 40,000
3.	Cumberland Sound	1,000 – 2,000
4.	Northern Hudson Bay	1,000 – 2,000
5.	Western Hudson Bay	24,000 – 48,000
6.	Southern Hudson Bay	2,000 – 4,000
7.	James Bay	3,000 – 6,000
8.	Eastern Hudson Bay	1,000 – 2,000
9.	Ungava Bay	20 – 40
10.	St-Lawrence estuary	460 – 920

Estimates of numbers in areas within the range of belugas in Canada *(*the first number is the estimate based on animals seen at the surface, the second assumes that there are in fact twice as many because of those missed by surveys while they are diving. This assumption is based on recent time-depth recordings.*

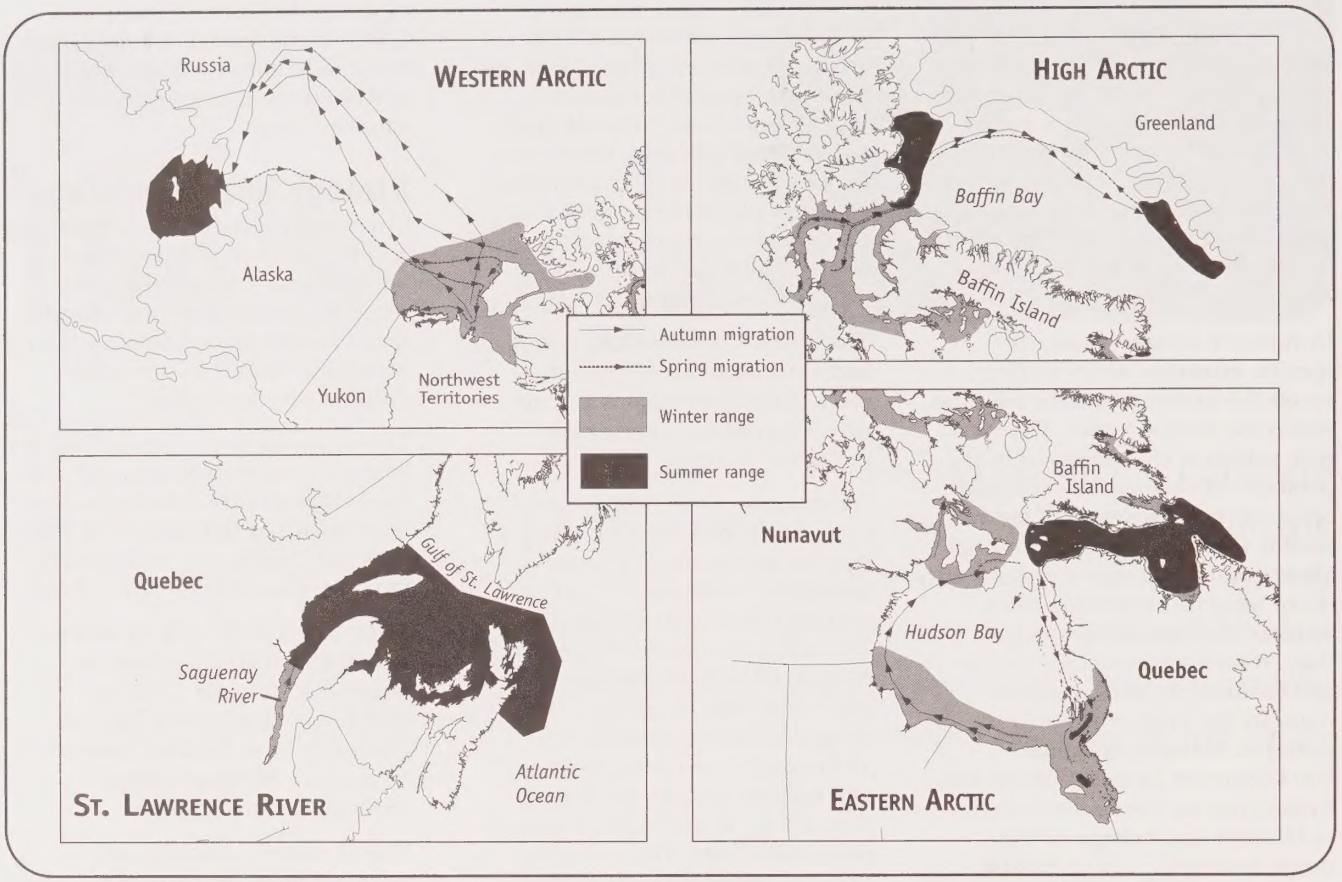


Figure 3. Migration of the beluga.

The mating system remains unknown but there are indications that males breed with several females.

Gestation lasts about 14 months and births occur between the end of June to early August. The lengthy gestation period, followed by a nursing period of some 18 months, results in females only being able to produce young approximately every 3 years.

The fat-rich milk of the mother results in rapid growth of the young. Newborn calves are about 40 per cent of their mother's length but reach 65 per cent of that length in the first year. They are weaned in their second year, by the end of which they measure more than 70 per cent of adult length.

Unlike larger whales, which are filter-feeders, trapping huge quantities of tiny crustaceans in grills called baleens suspended from the roof of the whale's mouth, belugas feed on fish and invertebrates using their teeth.

The beluga has a diverse diet. Food varies according to seasonal availability and consists of fish, such as capelin, Arctic cod and herring, and invertebrates, such as shrimp, squid and marine worms. During their time in the estuaries in the summer, belugas rarely feed on schooling fish. Outside the estuaries, they make frequent dives that are thought to be feeding dives, often to the bottom. The prey they are seeking have not been identified. During their migration to the wintering areas in the autumn, belugas from Arctic waters feed heavily on schools of Arctic cod. This appears to be a very important time of the year for the accumulation of a thick layer of blubber, which acts both as insulation and a large reserve of energy.

In order to feed successfully, belugas spend a significant amount of time under water. They are capable of frequent dives to depths of 400 to 800 metres. The deepest dive recorded from a male beluga was in excess of 1,000 metres! Like other marine mammals, belugas have specific adaptations for diving. They contain twice as much blood as land animals of similar size, with blood cells holding 10 times as much oxygen. Their muscles store the oxygen and the circulatory system is made up of a complex of valves and reservoirs that supplies the oxygen-sensitive brain with fresh blood during lengthy dives. Other adaptations related to diving include a lower sensitivity to carbon dioxide build-up and a greater ability of beluga muscles to operate with depleted oxygen.

Daily energy budgets of free-ranging belugas are not known. In captivity, average daily consumption of food is about 10 to 15 kilograms. This gives some indication of the productivity of Hudson Bay and Hudson Strait. There needs to be a large food supply to sustain the tens of thousands of belugas which summer or winter.

Belugas are warm-blooded, air-breathing mammals adapted to life in cold Arctic waters. Common to all marine mammals, the blubber layer, 2.5 to 9.5 centimetres of fat lying immediately below the skin, provides an efficient insulator that helps to maintain an internal body temperature of approximately 37°C in ice-filled waters. This is a large amount of fat, at times making up almost 50 per cent of the total body weight. As with most marine mammals, the storage of blubber reserves varies with the seasons.

Ecology

Our knowledge of the ecology of belugas is largely restricted to the ice-free summer season when they are found in large numbers within certain river estuaries. Belugas show fidelity to their summering area, with some identified individuals returning to the same areas year after year, even when they are frequently exposed to disturbances, such as hunting. Genetic studies of Arctic belugas would indicate a closer genetic relationship among belugas that share the same estuary than between belugas summering in different estuaries. This indicates that site fidelity is important to the population structure of belugas, at least for Arctic beluga populations.

Herds of belugas arrive in the summering areas and estuaries as soon as the ice permits their passage. At Cunningham Inlet (Somerset Island) in the High Arctic, the first whales arrive as the ice breaks in the second week of July and the last ones are seen in mid-August. At the Nastapoka and Churchill estuaries in Hudson Bay, whales arrive as early as mid-June and remain in or around these estuaries until early September. In the St. Lawrence Estuary, appreciable numbers of belugas are seen when ice disappears in late March or early April at the site where the St. Lawrence and Saguenay Rivers meet. Most of the behaviours observed in estuaries are related to the moulting of their skin, socializing and nurturing of young calves.

It appears that estuarine groupings consist of a high proportion of females with newborn and juveniles. Adult females with either newborn or yearling calves are often seen to be accompanied by juveniles, which might serve as attendants. While the parental ties have not been proven directly, it appears that such possible family units might be the basis of the beluga social structure.

Females in the Arctic spend much of their time in the quieter parts of the estuaries suckling their young. Newborn and yearling calves rarely leave the immediate vicinity of their mothers. Older age classes of grey calves form loose groupings that engage in a variety of behaviours. Pods of adult males, made up of 15 to 20 individuals, are seen in the larger estuaries, but usually remain apart from the others and are avoided by females with small calves. In the St. Lawrence Estuary, a similar pattern is observed, with females and juveniles being most often observed in the brackish and warm waters upstream of the Saguenay River, whereas groups of white adults (presumably males) concentrate in the colder, more marine waters downstream of the Saguenay.

It has been shown only recently that belugas are subject to a seasonal skin moult. Belugas have a very thick skin that is at least 10 times thicker than that of dolphins and 100 times thicker than that of terrestrial mammals. Their skin appears to be a very dynamic organ used for insulation, storage of high quantities of vitamin C and, possibly, protection from the abrasion caused by contact with ice. The removal of dead skin and the rapid growth of new skin cells take place when the belugas occupy the warm estuaries. In the early summer, whales in the estuary engage in activities that are directly related to changes in their skin. Individuals roll on the muddy or rocky bottoms at the mouth of river channels, which have strong currents. All age classes engage in this behaviour. This may be a particular feature of Hudson Bay belugas. It is not clear that the moult is as seasonal in the St. Lawrence Estuary.

Sound, Communication and Hearing

Belugas are very vocal animals. Nineteenth century whalers described hearing their sounds through the hulls of their wooden sailing ships. On a windless day

Figure 4.

Figure 5.

along an Arctic shoreline frequented by belugas, a camper can often hear the blows of surfacing belugas followed by a cacophony of sounds, ranging from high-pitched whistles to low, repeated grunts. Researchers have identified sixteen types of beluga vocalizations. These sounds are probably used for communication but their exact role is not fully understood. It has been observed that squawks are emitted with more frequency when belugas are alarmed.

Belugas have a well-developed sense of hearing and refined echolocation capabilities. Echolocation, detection of objects by sound, is important to a species that lives a good part of its life in dark waters. At depths greater than 100 metres, there is virtually no light and belugas have been observed making frequent dives to depths of several hundred metres. Light penetration in water is further reduced by silt runoff in river estuaries or by ice cover and the short days of the polar winter. To navigate and catch prey, belugas produce echolocation clicks that bounce off their prey, as well as allowing them to detect the sea bottom or the ice surface. The resulting echoes are captured by the belugas' keen sense of hearing. Their hearing may also serve to protect them from such predators as polar bears and killer whales.

Economic Value

Marine mammals have been the basis of the Inuit economy for over 4,000 years. They provide meat, fat, oil, leather, tools and materials for fabrication of arts and crafts. By the time of the development of the Thule culture, 800 to 1,000 years ago, belugas were an important food species. The top layers of the skin yield "muktuk," which is still highly prized as a food rich in vitamin C and high in energy content.

Beginning in the middle of the eighteenth century, commercial whaling for belugas continued over a period of 200 years for certain populations in the eastern Arctic and over a period of 93 years for the St. Lawrence population. In the Arctic, belugas were generally caught for commercial purposes in entanglement nets or drive fisheries in shallow waters. In the St. Lawrence, they were caught in weirs in the shallow areas and by means of rifles and harpoons in the deeper areas. Canada discontinued commercial whaling in 1972, and hunting for belugas in the St. Lawrence, for whatever purposes, was prohibited in 1979.

The total cumulative numbers of belugas caught for commercial purposes, uncorrected for sunk animals, were about:

- 11,000 in the High Arctic (1868-1898);
- 7,000 off south-eastern Baffin Island (1868-1939);
- 9,000 in western Hudson Bay (1949-1970);
- 9,900 in eastern Hudson Bay (1752-1916);
- 1,200 in Hudson Strait (1909-1940);
- 1,800 in Ungava Bay (1731-1938); and
- 14,500 in the St. Lawrence Estuary (1868-1960).

Modern beluga subsistence hunts are often cooperative efforts involving several hunters and vessels and are conducted using harpoons and rifles. The boats used in the past were mainly kayaks. These have been replaced by motorized freighter canoes and larger fishing vessels up to 15 metres in length.

Between 1988 and 1996, the total number of belugas caught in the Canadian Arctic for subsistence purposes varied between 400 and 700 per year. The annual harvest fluctuates in response to weather, availability of other wildlife species and implementation of management measures.

In Canada, live belugas were taken from the St. Lawrence up to the beginning of the 1960s and from the Churchill estuary since 1967. The total known number of belugas that were live-captured between 1967 and 1992 was 68. There have been no live captures for the aquarium trade since 1992, although some animals have been live-captured for scientific research since that date. No licenses to capture belugas have been given in recent years.

The ban on commercial whaling, intensification of conservation measures and an increase in public interest has led to the development of a new non-consumptive use. Whale watching is attracting a large number of tourists in the St. Lawrence Estuary and an increasing number in the Arctic. In the St. Lawrence, however, it is forbidden to include belugas in whale watching activities.

Management and Conservation

There are concerns for the conservation of beluga stocks in Canada. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has analyzed the status of many of the Canadian beluga populations. Its conclusions were as follows:

- St. Lawrence population, *endangered* category (1983 and 1997 evaluations)
- South-east Baffin Island-Cumberland Sound population, *endangered* category (1990)
- Ungava Bay population, *endangered* category (1988)
- Eastern Hudson Bay population, *threatened* category (1988)
- Eastern High Arctic/Baffin Bay population, *special concern* category (1992)
- Western Hudson's Bay population, *not at risk* category (1993)
- Beaufort Sea-Arctic Ocean population, *not at risk* category (1985)

Several of these populations were reduced by commercial exploitation in the past, some more so than others. At present, subsistence hunting in some parts of the Arctic is a concern because of its potential for continued decline or lack of recovery of the depleted populations. Other potential effects on these populations include habitat loss from shore development, build-up of toxic contaminants and disturbance by commercial shipping, ice breaking and whale watching activities.

Responsibility for beluga conservation, management and research, as for other marine species in Canadian waters, belongs to the federal department of Fisheries and Oceans (DFO). The Marine Mammal Regulations under the *Fisheries Act* are the legal basis upon which beluga management and conservation measures are enforced. The federal government has announced its intention to develop species at risk legislation and if enacted this might provide an additional legislative basis for beluga conservation. In order to meet its mandate and the obligations under Inuit land claim settlements, DFO is adopting a cooperative approach to the management of marine mammals in the land claim settlement areas. Resource management boards, composed equally of Inuit and government representatives, have been established in accordance with the claim agreements. These resource boards assist DFO in varying degree, in jointly managing Canadian Arctic beluga populations. The Marine Mammal Regulations prohibit any hunting of the St. Lawrence population of belugas. A consultative approach has also been adopted with the whale watching industry in the St. Lawrence, initially by DFO and more recently by the authorities of the Saguenay- St. Lawrence Marine Park. This park is the first one established in a marine habitat, and it is the result of initiatives started in 1988 by the federal government to protect belugas.

Present management or conservation measures vary with the specific challenges that need to be addressed. In the Arctic, wildlife management in general has to reconcile three main objectives: wildlife rehabilitation and conservation, assurance of a continued sustainable use of the resource and respect of agreements defining aboriginal priority and hunting rights. The management tools used for beluga populations that are threatened or endangered include the creation of sanctuaries, the establishment of quotas or, if necessary, the total closure of the hunt to restore the population. Regulations include rules about hunting such as the calibre of rifle, use of edible parts, protection of the females accompanied by calves and prohibition of disturbance.

The conservation of the St. Lawrence beluga population was initially guided by government-wide action plans. A formal recovery plan was developed in 1995 under the joint leadership of DFO and the World Wildlife Fund Canada. This recovery plan includes strategies to reduce contamination and disturbance of beluga habitat, to prepare adapted emergency plans, to monitor the health and dynamics of the population and to pursue research for new information. Implementation is ongoing, under the initiative of various agencies and organizations including DFO, the Saguenay-St. Lawrence Marine Park, St. Lawrence Vision 2000 governmental partners and many non-governmental organizations.

Education and outreach also constitute important aspects of management, since conservation of renewable resources and their habitats is usually only achieved through the cooperation of all users.

Current Research

The strong evidence that belugas return to certain Arctic summering areas and the mixing of neighbouring summer groups in the winter necessitates further research on the identification of individual stocks. Current data from genetic analyses support the behavioural evidence, indicating that stocks are defined by female groupings in estuaries. Further genetic and chemical analyses can quantify the degree of separation of these stocks, as well as the amount of inbreeding. Management efforts could be altered as a result of this research.

Summer and autumn tagging of individuals with satellite-linked tracking instruments has revealed the extent of the summer range of belugas beyond the estuarine groupings, and the routes and timing of their autumn migrations. This provides vital information about which stocks are being harvested by different hunting groups at different times of the year. Satellite-linked, time-depth recorders are providing new knowledge on the feeding ecology of belugas by identifying the location, frequency and depths of dives. This, in turn, can be used to determine what prey are being sought and to carry out evaluations of the size of the standing stocks of prey species used by the beluga populations. Time-depth recordings

also provide data to correct aerial population surveys based on counts of animals at or near the surface. These recordings allow an estimation of the proportion of animals that are missed by the aerial surveys because they are diving too deeply to be detected visually.

Contaminants are the focus of much research in the St. Lawrence. Many industrial substances could have a negative impact on the health of marine mammals. While direct links between these chemicals and changes in the St. Lawrence population have yet to be established, there is certainly cause for concern and vigilance. In the Arctic, and even in the St. Lawrence, there is evidence of a decline in both PCBs and DDT in some marine mammals in the last 10 years. Yet, because of the high consumption of marine mammal fat by Aboriginal people, there is a concern about the effect of PCBs on human health.

Conventional population studies on belugas have been plagued with difficulties in attempting to estimate population size, as well as birth and death rates. The precision achieved by the best aerial surveys to date is not sufficient to detect small, short-term changes in population size. Demographic studies based on age structure from dead animals in Inuit catches, or from those washed ashore in the St. Lawrence, suffer from many biasing factors that obscure real death rates.

Future efforts in population assessment and dynamics should continue to concentrate on the development of techniques based on the monitoring of live animals. Combined studies using satellite tracking, time-depth recording of animals and detailed aerial photography, together with new genetic and chemical analysis methods, are the most promising future research directions.

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To which category does this species belong?

Further Reading

Note: You should be able to find most of these articles in your local college or university library. Despite their usefulness as general sources of information on beluga whales, several of these references may not reflect the recently published information given in this report, particularly with respect to new beluga population estimates, range extensions and some aspects of their ecology.

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Revised by:

Pierre Richard
Fisheries and Oceans Canada
Freshwater Institute
501 University Crescent
Winnipeg, Manitoba R3T 2N6

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Fax: (613) 990-1866
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